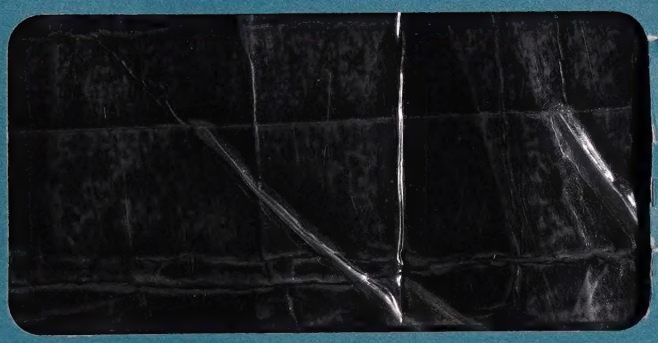

ASSOCIATED RESEARCH, INC.
8221 N. KIMBALL AVENUE, SKOKIE, IL 60076
PHONE: (312) 647-7850
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INSTRUCTION MANUAL

Model 05321-A

PORTABLE DC HYPOT ®

SAFETY

The Test Operator must follow all accepted safety practices, proceed with caution and do all in his power to assure a safe test.

Because of the inherent dangers in any High Voltage work, special care must be taken to safeguard personnel during any testing or fault finding.

GENERAL

Regardless of the type of test to be made or fault to be found, certain preliminary steps should precede the actual test. First, open all switches and breakers to de-energize the cable or equipment and isolate the item. Using a hot stick and rubber gloves, ground all sections of the test item to insure that it is not charged.

Careful advance planning is essential to a proper and safe test. Proper test equipment, ground leads, high voltage cables, hot stick, rubber gloves and any other special tools should be assembled at the test site.

The equipment to be tested should be de-energized, *properly grounded and disconnected. Cables to be tested should be de-energized, *properly grounded, and isolated from other components such as switch gear, transformers, lightning arrestors, etc. Both ends of a cable to be tested should be disconnected and protected to safeguard passing personnel. The conductors at the far end of a cable should be separated and taped to avoid external flash over or leakage during the test.

A man should be stationed at any point where the test item is accessible to unauthorized people and barriers should be erected. Signs should be posted that read "DANGER - HIGH VOLTAGE TEST IN PROGRESS, KEEP AWAY". Do not use terms such as "Kilovolts", "KV: or "HV" because the average person does not understand the true meaning of these terms or abbreviations.

Decide upon the proper test procedure to be followed before starting the test.

HIGH VOLTAGE TESTING

After making any test turn the High Voltage switch off and return the voltage control to zero or minimum position, check the kilovoltmeter for a zero indication (on DC test the capacitive element of the test item will hold a charge and may take a long time to discharge) and *ground the test item before disconnection. After a DC test has been performed the ground should be left on the item for at least as long as the total time high voltage was applied to prevent a voltage build up due to absorption current. It is best to leave a ground on a test item any time it is not in service or undergoing a test.

*Any time a ground is to be placed on a circuit it should first be grounded with a hot stick and rubber gloves. All circuits not in use (or connected to a guard or bypass circuit) should be grounded.

FAULT FINDING

Make an insulation resistance test on the faulted cable between the conductor and ground, shield or housing before testing on both ends of a cable to determine the condition of the fault. Consider all the factors effecting the faulted cable, such as the resistance of the fault, the age of the cable, the condition of the ground (if buried), the humidity, the voltage rating of the cable, etc. and decide on the best test method or methods to be used.

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FAULT FINDING - Cont.

Because of the heavy pulse current (possibly thousands of amperes) generated with capacitance discharge equipment, it is absolutely essential that careful attention be paid to proper grounding and safety practices. The test equipment should be tied to a good earth ground with as short and heavy a connection as possible. The unused phases of a multi-phase cable and the sheath or neutral should also be tied to this same ground.

EQUIPMENT GROUNDING INSTRUCTIONS

It is absolutely essential for safety of operating personnel as well as for proper operation of the test equipment, that the equipment be effectively grounded. Effectively grounded, as defined in the national electrical code, means "..... connected to earth through a ground connection of sufficiently low impedance and having sufficient ampacity to prevent the building up of voltage which may result in undue hazard to connected equipment or to persons."

Depending on the power input requirements, some instruments may be equipped with a power input cable having a three-prong grounding type plug, a two-prong plug with grounding clip, or a three conductor cable terminating in lugs (where one lug is for ground connection). In any case an effective ground connection must be provided.

Where a three-prong grounding type plug is used, the equipment will be grounded through the ground prong provided that the receptacle itself is effectively grounded through a low impedance ground connection.

On instruments equipped with a two-prong plug and grounding clip, a three conductor line cord terminated in lugs, or where a two-prong adapter is used on a three-prong plug, the grounding clip or lead must be connected to a low impedance earth ground. For a low impedance earth ground, a continuous metallic underground water system may be used for ground connection. Where this is not available a driven ground rod may be used to provide an effective earth ground. In either case the resistance to ground of the piping system or driven ground rod should not exceed 25 ohms as required by the National Electrical Code.

Some instruments are equipped with a safety ground terminal in addition to the grounding conductor in the line cord. This terminal should be connected to an auxiliary grounding electrode, having low impedance, such as a piping system or driven ground referred to above. This terminal should be connected to ground with heavy wire.

If test equipment is being used in the field where input power is provided by a gasoline engine driven alternator, generator, or a battery operated converter, it is essential that not only the test equipment but also the metallic framework or housing of the power source be grounded.

Failure to comply with the above equipment grounding instructions could result in dangerous electrical shock to operating personnel.

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Schematic Diagram

ASSOCIATED RESEARCH, INC.

MODEL SPECIFICATION - DC HYPOT

MODEL NUMBER:	5321
DESCRIPTION:	Portable dc Hypot - Two Piece
PRIMARY APPLICATION:	Dielectric withstand testing of rotating machinery, transformers, switchgear and cables for acceptance and routine maintenance in the field.
INPUT	
Voltage:	120 volts nominal
Frequency:	60 Hz
Phase:	Single
Current:	8 amperes
OUTPUT	
Voltage	0-100 kV dc continuously adjustable
kVA	.5
Frequency:	dc
Current:	5 milliamperes
Duty Cycle:	Continuous
Failure Detector:	Current sensitive overload system monitoring current in return side of output. Fixed sensitivity at 5 MA
Shorting Device:	Automatic output shorting solenoid.
VOLTAGE CONTROL:	Manually operated, equipped with zero return interlock system to avert misapplication of High Voltage.
METERING	
Kilovoltmeter:	Analog -- 0-25/50/100 kV
Microammeter:	Analog -- 0-5/50/500/5000 microamperes
Range:	Three range kV meter, four range Microammeter
TERMINATION	
Input:	5 ft. (1.53 Meter) 3 conductor power cable terminated in a 3 prong grounding type plug.
H.V.:	Receptacle with disconnectable coaxial cable (Superflex) terminated in lug (Std. 15 ft. (4.57m), options available)
Return:	Metered-Bypass-Ground terminals with 15 ft. (4.57 meter) disconnectable leads terminated in insulated clips.
Interconnection:	Receptacles on H.V. unit and control unit with 10 ft. (3.05 meter) interconnecting cable.
CABINETRY	Portable HV power supply 19½" (49.5 cm) x 19½" (49.5 cm) x 9" (22.9 cm).
WEIGHT:	H.V. Power Supply = 89 lbs (40.37 kg) Control Unit = 25 lbs (11.34 kg)

GENERAL FEATURES

CONTROL SECTION

LINE CORD

Three conductor input power cable terminated in either a three-prong grounding type plue (if adapter is used, connect the ground lead to earth ground, or two-prong plug with ground lead and clip.

CONTROL CABLE

Ten conductor control cable terminated in a male connector (for connection to control section) and a female connector (for connection to high voltage section). This cable provides only control signals necessary for operation of the two sections and does not carry any high voltage.

CAUTION: DO NOT connect LINE CORD until CONTROL CABLE is connected to BOTH sections. DO NOT disconnect CONTROL CABLE until KILOVOLTMETER reads zero and LINE CORD is disconnected.

CONTROL CABLE CONNECTOR

For connecting the CONTROL CABLE to the CONTROL SECTION.

POWER SWITCH/CIRCUIT BREAKER/INDICATOR

The AC input line is protected against overloads by an illuminated switch/ circuit breaker. If excessive current flows in primary circuit, the circuit breaker will open.

Should the breaker ever open, the cause should be investigated.

HIGH VOLTAGE SWITCH

This HIGH VOLTAGE ON-OFF switch, operating in the low voltage input line controls the energizing or de-energizing of the high voltage control circuit. With this switch in the OFF position, the high voltage control circuit is de-energized and no high voltage is available at the output termination, regardless of the position of the VOLTAGE control. In the ON position with the VOLTAGE control at zero volts, the high voltage control circuit will be energized and the switch will remain in this position until turned OFF by the operator.

HIGH VOLTAGE INDICATOR

Red lens lamp indicates the high voltage control circuit is energized.

KILOVOLTMETER

This meter is connected directly across the output terminals, thus indicating the true terminal voltage being applied to the test item, and is therefore independent of internal regulation.

KILOVOLTS SELECTOR SWITCH

This switch provides for selecting KILOVOLTMETER ranges. The VOLTAGE control travel will be approximately the ratio of the selected range to the maximum range.

ELECTRONIC CURRENT METER AND CALIBRATION

Indicates the leakage current in the METERED RETURN side of the output circuit. This current meter is driven by a high gain balanced bridge amplifier which is powered by an independent dc power supply. The amplifier is electronically protected against burnout should it be accidentally overloaded.

Recalibration is necessary whenever the electron tube, meter or any component part of the electronic current metering circuit is replaced.

If the tube is replaced, the instrument power should be left ON for at least 24 hours to age the tube before proceeding with the calibration. The procedure for this calibration consists of the

CONTROL SECTION - Cont'd

following steps:

1. Remove LINE cord from power source.

2. Remove the four (4) corner screws from the control panel.

3. Lift panel from case and replace the defective component.

4. Replace panel.

5. Place the POWER and HIGH VOLTAGE switches to OFF position and rotate VOLTAGE control to full counter-clockwise position.

6. Set mechanical zero of both the KILOVOLTMETER and MICROAMMETER.

7. Connect the CONTROL CABLE to the CONTROL and HIGH VOLTAGE sections and connect the LINE cord to a power source as indicated on the nameplate and specifications sheet.

8. Place the POWER switch in the ON position and allow the instrument to warm up for 90 seconds.

9. Place the KILOVOLTS selector switch on the lowest range.

10. Place the MICROAMPERES switch in the next to lowest range.

11. A resistive load with 1% tolerance is required to accurate calibration of the current meter. The resistance of the load is calculated by R=E/I, where E is the full scale voltage on the lowest KILOVOLT range. "I" is the full scale current on the next to the lowest MICROAMPERES range. The wattage rating of the load should be at least twice the calculated E x I. Connect this load between the HIGH VOLTAGE output and METERED RETURN. Place the GROUND switch in the BYPASS RETURN position.

12. The two (2) potentiometers that control calibration are:

    (a) Zero Adjust
    (b) Full Scale Adjust.

13. Turn the ZERO ADJUST until the MICROAMMETER pointer rests at ZERO.

14. Place the HIGH VOLTAGE lever switch in the ON position.

15. Increase the output voltage to the value of "E" chosen in Step 11 and turn the FULL SCALE ADJ. until the MICROAMMETER pointer rests at FULL SCALE. Decrease voltage to zero.

16. The current meter is now calibrated.

MICROAMPERES SELECTOR SWITCH

Provides for selecting MICROAMMETER ranges. The highest range facilitates metering of charging current and the intermediate or lower ranges provide easier and more accurate indication of lower current.

VOLTAGE CONTROL

A continuously variable VOLTAGE control gives the operator smooth control of the output voltage from zero to maximum. This VOLTAGE control is equipped with a zero return interlock switch, making it necessary for the control to be at its zero output volts position before the high voltage control circuit can be energized. This prevents the sudden application of high voltage to the item under test.

METERED RETURN AND BYPASS TERMINALS AND GROUND SWITCH

The switch (located on the CONTROL SECTION) in conjunction with the METERED RETURN and BYPASS RETURN terminals (located on the HIGH VOLTAGE SECTION) provides a means for directing the unwanted current around the current meter by grounding either the METERED

CONTROL SECTION - Cont'd

RETURN or the BYPASS RETURN terminal.

By connecting the return side of the specimen to the METERED RETURN terminal and selecting BYPASS RETURN with the ground switch (which grounds the BYPASS RETURN terminal) all leakages from the high voltage connection to the specimen, to ground and other unwanted leakages to ground will be directed around the current meter. By selecting METERED RETURN with the GROUND switch (which grounds the METERED RETURN terminal), the total leakage to ground will flow through the current meter.

When testing a specimen that may have isolated metallic parts that provide a leakage path between the two points where the high voltage and return connections are made, the BYPASS RETURN terminal may be used as a guard circuit. If these isolated metallic parts are connected together and to the BYPASS RETURN terminal, any leakage from the high voltage point to these parts will be directed around the metering circuit.

NOTE: When using the BYPASS RETURN terminal as a guard circuit, the GROUND switch should be in the BYPASS RETURN position unless the specimen return side is earth ground. Under this condition the GROUND switch should be in the complete description and use of METERED RETURN and BYPASS RETURN terminals and GROUND switch.

HIGH VOLTAGE SECTION

CONTROL CABLE CONNECTOR

For connecting the CONTROL CABLE to the HIGH VOLTAGE SECTION.

CAUTION: DO NOT connect line cord until CONTROL CABLE is connected to BOTH CONTROL and HIGH VOLTAGE SECTIONS. DO NOT disconnect CONTROL CABLE until KILOVOLTMETER reads zero and LINE cord is disconnected.

GROUND TERMINAL

Provides external connection for high voltage cable shield and for SAFETY grounding the HYPOT case.

BYPASS AND METERED RETURN TERMINALS

See BYPASS RETURN and METERED RETURN TERMINALS and GROUND SWITCH in GENERAL FEATURES - CONTROL SECTION.

SAFETY INTERLOCK RECEPTACLE

The SAFETY INTERLOCK receptacle provides for interlocking the high voltage control circuit from a remotely located switch. This receptacle is electrically located in series with the high voltage lever switch, and has a jumper wire across the terminals of the mating plug as the instrument is shipped from the factory. To use the SAFETY INTERLOCK, remove the twist-lock plug from its receptacle and remove the jumper wire from its terminals. Connect the wires of the remotely located switch to the terminals of the plug and re-insert the plug into its twist-lock receptacle. While the remotely located switch is open, the high voltage control circuit will be disabled and no high voltage will be available at the output termination, regardless of the setting of

HIGH VOLTAGE SECTION

any other controls on the instrument. This switch must be closed in conjunction with the other conditions described under HIGH VOLTAGE SWITCH.

HIGH VOLTAGE OUTPUT TERMINATION

Disconnectable shielded high voltage cable.

CAUTION: This cable should NOT BE connected to the HIGH VOLTAGE SECTION until the CONTROL CABLE is connected to the CONTROL SECTION and HIGH VOLTAGE SECTION and the KILOVOLTMETER indicates zero.

OPERATING INSTRUCTIONS

The test operator must follow all accepted safety practices, proceed with caution, and do all in his power to assure a safe test. Because of the inherent dangers in any high-voltage work, special care must be taken to safeguard personnel during any testing.

1. Place the POWER and HIGH VOLTAGE switches on the OFF position.

2. Connect the CONTROL cable to the CONTROL and HIGH VOLTAGE sections.

3. Rotate the VOLTAGE control knob fully counter-clockwise.

4. Connect the LINE cord to a source of power as indicated on the nameplate.

5. Place the POWER switch on the ON position and allow a 90 second warm up period.

6. Connect the shield of the high voltage cable to the SAFETY GROUND terminal and plug the high voltage cable into the HIGH VOLTAGE OUTPUT.

7. Connect the item to be tested to the high voltage output cable and to the METERED RETURN terminal and select METERED RETURN with the GROUND switch (see GENERAL FEATURES section of this manual and DC HYPOT TESTING MANUAL for complete description and use of this selective return circuit.

8. Turn the KILOVOLTS switch to the desired range.

9. Turn the MICROAMPERES switch to the required range depending on the expected leakage current. If the leakage current is unknown, turn this switch to the highest range.

10. Activate the H.V. switch to the ON position.

11. Rotate the VOLTAGE control clockwise until the required test voltage is indicated by the KILOVOLTMETER or until the maximum acceptable leakage current (as indicated by the MICROAMMETER) is reached.

12. The leakage current can be read on the MICROAMMETER. If greater sensitivity is desired, select a lower current range with the MICROAMPERES range switch.

13. The MICROAMPERES range or KILOVOLTS range may be changed at any time during a test to maintain best readability.

14. Should the item under test fail, high voltage will be de-energized.

15. To re-energize high voltage, repeat Steps 3 and 10.

16. To re-energize high voltage should the HV switch or POWER switch be turned OFF, or a remotely located switch be opened, it will be necessary to reclose the switch and repeat Steps 3 and 10.

REPLACEMENT PARTS LIST

SYMBOL	PART NUMBER	DESCRIPTION
C-1	10425	Capacitor, .5 uF, 600 V
C-2	14476	Capacitor, 1 uF, 1000 V
CA-1	11649	Cable Assembly, input
CA-	3093[illegible]	Cable Assembly, HV, Std. l[illegible] (.57 m) *optional length available
CA-3	17118	Cable Assembly, control
CB-1	31670	Circuit Breaker, 10 A (POWER)
CN	11729	Connector, female (SAFETY INTERLOCK)
FL-1	17709	Filter Capacitor
I-1	14159	Indicator Assembly, red lens
I-3	16437	Lamp, indicator
M-1,2	32931	Meter, dc, 50 uA
NE-1,3-5	58591	Lamp, neon 2
NE-2	15485	Lamp, neon 32
PL-1	11730	Plug, cable (SAFETY INTERLOCK)
PS-1	16759	Amplivolt Assembly
R-1,2	57031	Resistor, fixed, 100 K, 10%, 1/2 W
R-3	11823	Resistor, fixed, 500 K, 1%, 1/2 W
R-4	11821	Resistor, fixed, 50 K, 1%, 1/2 W
R-5	10853	Resistor, fixed, 5 K, 1%, 1/2 W
R-6	15294	Resistor, fixed, 500 ohm, 1%, 1/2 W
R-10	14812	Resistor, fixed, 3.3 K, 1%, 1/2 W
R-11	58[illegible]34	Resistor, fixed, 10 K, 10%, 1/2 W
R-12	14743	Resistor, variable, 10 K, 2 W
R-13	14867	Resistor, variable, 5 K, 2 W
R-14	11825	Resistor, fixed, 10 K, 1%, 1/2 W
R-15	10948	Resistor, fixed, 3.5 K, 1%, 1/2 W
R-16	14790	Resistor, fixed, 22 K, 5%, 1/2 W
RY-1	17779	Relay, 3 PDT
RY-2	14203	Relay, current sense
S-1	16679	Switch, toggle, (GROUND)
S-2	59690	Switch, toggle (HV)
S-3	17621	Switch, snap, micro
S-4	16681	Switch, rotary (KILOVOLTS)
S-5	16583	Switch, rotary (MICROAMPERES)

REPLACEMENT PARTS LIST - Cont'd

T-1	58864	Transformer, variable
TER-1	11817	Terminal Post, black (BYPASS)
TER-2	10304	Terminal (SAFETY GROUND)
TER-3	11818	Terminal Post, red (METERED)
	9210	Cable Assembly Kit

*For other than 15 ft. (4.57 m) std. length, order by Model No., Serial No., and desired length.

SHUNT ASSEMBLY (SA-1) P/N 34003

R-1	58047	Resistor, fixed, 15 K, 1%, 1/2 W
R-2	10948	Resistor, fixed, 3.5 K, 1%, 1/2 W
R-3	16211	Resistor, variable, 25 K, 20%, 1/4 W

AMPLIFIER ASSEMBLY PN - 32175

C-1	10668	Capacitor, Elec., 20 uF, 250 V
C-2,3	17175	Capacitor, paper, .22 uF, 100 V
R-1	10733	Resistor, Fixed, 36 K, 5%, 1/2 W
R-2	14795	Resistor, Fixed, 68 K, 5%, 1/2 W
R-3	58343	Resistor, Fixed, 2.2 MEG, 10%, 1/2 W
R-4,5	10514	Resistor, Fixed, 2.7 K, 5%, 1/2 W
R-7	14723	Resistor, Variable, 1 K, 20%, 2 W
R-8	17614	Resistor, Variable, 50 K, 20%, 1/4 W
R-9	14743	Resistor, Variable, 10 K, 2 W
R-10	58309	Resistor, Fixed, 47 K, 5%, 1/2 W
R-11	18445	Resistor, Fixed, 1 MEG, 1%, 1/2 W
RT-1	14503	Rectifier, Silicon, Low voltage
T-1	11913	Transformer, Power
V-1	15349	Tube, Vacuum, 12 AU7

B-33132

USED ON

MODEL 05321A

SYMBOL IDENTIFICATION MODEL 05321A

SYMBOL	PART NUMBER	ASSEMBLY
AMPLV.-1	05321A-01	05321A-0
CA-3	05321A-03	05321A-0
CA-2	05321A-04	05321A-0
AMPLIF-1	05220A-10	05321A-02
TR-4	10304	05321A-05
FL-1	17709	05321A-05
CA-1	11649	05321A-06
I-1	14159	05321A-06
S-1	16679	05321.A-06
S-2	59690	053.21A-06
RECP-1	16193	05321A-06
CB-1	31670	05321A-06
R-11	58334	05321A-06
R-1,2	57031	05321A-06
C-1	10425	05321A-06
NE-4	58591	05321A-06
R-13	14867	05321A-10
R-12	14743	05321A-10
RY-1	17779	05321A-10
RY-2	14203	05321A-10
C-2	14476	05321A-10
NE-1,2	15485	05321A-10
R-10	14812	05321A-10
S-5	16583	05321A-11
R-5	10853	05321A-11
R-4	11821	05321A-11
R-3	11823	05321A-11
R-6	15294	05321A-11
S-4	16681	05321A-12
R-15	10948	05321A-12
R-14	11825	05321A-12
T-1	58864	05321A-16
S-3	17621	05321A-16
R-2	10948	05321A-21
R-1	58047	05321A-21
R-3	16211	05321A-21
TR-3	11818	05321A-28
TR-1	11817	05321A-28
RECP-2	16194	05321A-28
CN-3	11729	05321A-28
TR-2	10304	05321A-28
R-16	14790	05321A-28
I-3	16437	05321A-28
PL-1	11730	05321A-28
NE-3,5	58591	05321A-28

*REPLACES MODEL 5321

LET.	CHANGE	DATE	BY	APP.
B	Added SYMBOL IDENT. FOR C 33132 SHT. 202	2/3/61	EB	NW
A	ORIGINAL ISSUE			

ASSOCIATED RESEARCH, INC.
3758 WEST BELMONT AVENUE, CHICAGO, ILLINOIS 60618

TOL.

SCHEMATIC WIRING DIAGRAM
*MODEL 05321 A

DWN.	APP.	B33132-B
CKD.	SHT. 2 OF 2	

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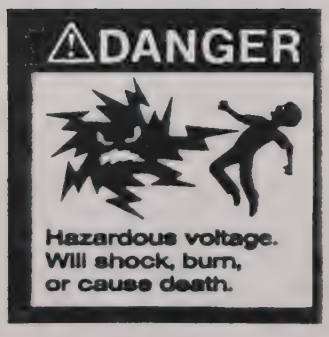
INSTRUCTION MANUAL

Model 05321-A

PORTABLE DC HYPOT ®



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Regardless of the type of test to be made or fault to be found, certain preliminary steps should precede the actual test. First, open all switches and breakers to de-energize the cable or equipment and isolate the item. Using a hot stick and rubber gloves, ground all sections of the test item to insure that it is not charged.

Careful advance planning is essential to a proper and safe test. Proper test equipment, ground leads, high voltage cables, hot stick, rubber gloves and any other special tools should be assembled at the test site.

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Decide upon the proper test procedure to be followed before starting the test.

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After making any test turn the High Voltage switch off and return the voltage control to zero or minimum position, check the kilovoltmeter for a zero indication (on DC test the capacitive element of the test item will hold a charge and may take a long time to discharge) and *ground the test item before disconnection. After a DC test has been performed the ground should be left on the item for at least as long as the total time high voltage was applied to prevent a voltage build up due to absorption current. It is best to leave a ground on a test item any time it is not in service or undergoing a test.

*Any time a ground is to be placed on a circuit it should first be grounded with a hot stick and rubber gloves. All circuits not in use (or connected to a guard or bypass circuit) should be grounded.

FAULT FINDING

Make an insulation resistance test on the faulted cable between the conductor and ground, shield or housing before testing on both ends of a cable to determine the condition of the fault. Consider all the factors effecting the faulted cable, such as the resistance of the fault, the age of the cable, the condition of the ground (if buried), the humidity, the voltage rating of the cable, etc. and decide on the best test method or methods to be used.

FAULT FINDING - Cont.

Because of the heavy pulse current (possibly thousands of amperes) generated with capacitance discharge equipment, it is absolutely essential that careful attention be paid to proper grounding and safety practices. The test equipment should be tied to a good earth ground with as short and heavy a connection as possible. The unused phases of a multi-phase cable and the sheath or neutral should also be tied to this same ground.

EQUIPMENT GROUNDING INSTRUCTIONS

It is absolutely essential for safety of operating personnel as well as for proper operation of the test equipment, that the equipment be effectively grounded. Effectively grounded, as defined in the national electrical code, means "..... connected to earth through a ground connection of sufficiently low impedance and having sufficient ampacity to prevent the building up of voltage which may result in undue hazard to connected equipment or to persons."

Depending on the power input requirements, some instruments may be equipped with a power input cable having a three-prong grounding type plug, a two-prong plug with grounding clip, or a three conductor cable terminating in lugs (where one lug is for ground connection). In any case an effective ground connection must be provided.

Where a three-prong grounding type plug is used, the equipment will be grounded through the ground prong provided that the receptacle itself is effectively grounded through a low impedance ground connection.

On instruments equipped with a two-prong plug and grounding clip, a three conductor line cord terminated in lugs, or where a two-prong adapter is used on a three-prong plug, the grounding clip or lead must be connected to a low impedance earth ground. For a low impedance earth ground, a continuous metallic underground water system may be used for ground connection. Where this is not available a driven ground rod may be used to provide an effective earth ground. In either case the resistance to ground of the piping system or driven ground rod should not exceed 25 ohms as required by the National Electrical Code.

Some instruments are equipped with a safety ground terminal in addition to the grounding conductor in the line cord. This terminal should be connected to an auxiliary grounding electrode, having low impedance, such as a piping system or driven ground referred to above. This terminal should be connected to ground with heavy wire.

If test equipment is being used in the field where input power is provided by a gasoline engine driven alternator, generator, or a battery operated converter, it is essential that not only the test equipment but also the metallic framework or housing of the power source be grounded.

Failure to comply with the above equipment grounding instructions could result in dangerous electrical shock to operating personnel.

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Schematic Diagram

ASSOCIATED RESEARCH, INC.

MODEL SPECIFICATION - DC HYPOT

MODEL NUMBER:	5321
DESCRIPTION:	Portable dc Hypot - Two Piece
PRIMARY APPLICATION:	Dielectric withstand testing of rotating machinery, transformers, switchgear and cables for acceptance and routine maintenance in the field.
INPUT	
Voltage:	120 volts nominal
Frequency:	60 Hz
Phase:	Single
Current:	8 amperes
OUTPUT	
Voltage	0-100 kV dc continuously adjustable
kVA	.5
Frequency:	dc
Current:	5 milliamperes
Duty Cycle:	Continuous
Failure Detector:	Current sensitive overload system monitoring current in return side of output. Fixed sensitivity at 5 MA
Shorting Device:	Automatic output shorting solenoid.
VOLTAGE CONTROL:	Manually operated, equipped with zero return interlock system to avert misapplication of High Voltage.
METERING	
Kilovoltmeter:	Analog -- 0-25/50/100 kV
Microammeter:	Analog -- 0-5/50/500/5000 microamperes
Range:	Three range kV meter, four range Microammeter
TERMINATION	
Input:	5 ft. (1.53 Meter) 3 conductor power cable terminated in a 3 prong grounding type plug.
Output:	Receptacle with disconnectable coaxial cable (Superflex) terminated in lug (Std. 15 ft. (4.57m), options available)
Return:	Metered-Bypass-Ground terminals with 15 ft. (4.57 meter) disconnectable leads terminated in insulated clips.
Unit Interconnection:	Receptacles on H.V. unit and control unit with 10 ft. (3.05 meter) interconnecting cable.
DIMENSIONS:	Portable HV power supply, 19½" (49.5 cm) x 19½" (49.5 cm) x 9" (22.9 cm).
WEIGHT:	H.V. Power Supply = 89 lbs (40.37 kg) Control Unit = 25 lbs (11.34 kg)

CONTROL SECTION

LINE CORD

Three conductor input power cable terminated in either a three-prong grounding type plug (if adapter is used, connect the ground lead to earth ground, or two-prong plug with ground lead and clip.

CONTROL CABLE

Ten conductor control cable terminated in a male connector (for connection to control section) and a female connector (for connection to high voltage section). This cable provides only control signals necessary for operation of the two sections and does not carry any high voltage.

CAUTION: DO NOT connect LINE CORD until CONTROL CABLE is connected to BOTH sections. DO NOT disconnect CONTROL CABLE until KILOVOLTMETER reads zero and LINE CORD is disconnected.

CONTROL CABLE CONNECTOR

For connecting the CONTROL CABLE to the CONTROL SECTION.

POWER SWITCH/CIRCUIT BREAKER/INDICATOR

The AC input line is protected against overloads by an illuminated switch, circuit breaker. If excessive current flows in primary circuit, the circuit breaker will open.

Should the breaker ever open, the cause should be investigated.

HIGH VOLTAGE SWITCH

This is the HIGH VOLTAGE ON-OFF switch, operating in the low voltage input line controls the energizing or de-energizing of the high voltage control [illegible] Voltage is available at the output termination, regardless of the position of the VOLTAGE control. In the ON position with the VOLTAGE control at zero volts, the high voltage control circuit will be energized and the switch will remain in this position until turned OFF by the operator.

HIGH VOLTAGE INDICATOR

Red lens lamp indicates the high voltage control circuit is energized.

KILOVOLTMETER

This meter is connected directly across the output terminals, thus indicating the true terminal voltage being applied to the test item, and is therefore independent of internal regulation.

KILOVOLTS SELECTOR SWITCH

This switch provides for selecting KILOVOLTMETER ranges. The VOLTAGE control travel will be approximately the ratio of the selected range to the maximum range.

ELECTRONIC CURRENT METER AND CALIBRATION

Indicates the leakage current in the METERED RETURN side of the output circuit. This current meter is driven by a high gain balanced bridge amplifier which is powered by an independent dc power supply. The amplifier is electronically protected against burnout should it be accidentally overloaded.

Recalibration is necessary whenever the electron tube, meter or any component part of the electronic current metering circuit is replaced.

If the tube is replaced, the instrument power should be left ON for at least 24 hours to age the tube before proceeding with the calibration. The procedure for this calibration consists of the

CONTROL SECTION - Cont'd

following steps:

1. Remove LINE cord from power source.

2. Remove the four (4) corner screws from the control panel.

3. Lift panel from case and replace the defective component.

4. Replace panel.

5. Place the POWER and HIGH VOLTAGE switches to OFF position and rotate VOLTAGE control to full counter-clockwise position.

6. Set mechanical zero of both the KILOVOLTMETER and MICROAMMETER.

7. Connect the CONTROL CABLE to the CONTROL and HIGH VOLTAGE sections and connect the LINE cord to a power source as indicated on the nameplate and specifications sheet.

8. Place the POWER switch in the ON position and allow the instrument to warm up for 90 seconds.

9. Place the KILOVOLTS selector switch on the lowest range.

10. Place the MICROAMPERES switch in the next to lowest range.

11. A resistive load with 1% tolerance is required to accurate calibration of the current meter. The resistance of the load is calculated by R=E/I, where E is the full scale voltage on the lowest KILOVOLT range. "I" is the full scale current on the next to the lowest MICROAMPERES range. The wattage rating of the load should be at least twice the calculated E x I. Connect this load between the HIGH VOLTAGE output and METERED RETURN. Place the GROUND switch in the BYPASS RETURN position.

12. The two controls on the CONTROL SECTION used for calibration are:

    (a) Zero Adjust
    (b) Full Scale Adjust.

13. Turn the ZERO ADJUST until the MICROAMMETER pointer rests at ZERO.

14. Place the HIGH VOLTAGE lever switch in the ON position.

15. Increase the output voltage to the value of "E" chosen in Step 11 and turn the FULL SCALE ADJ. until the MICROAMMETER pointer rests at FULL SCALE. Decrease voltage to zero.

16. The current meter is now calibrated.

MICROAMPERES SELECTOR SWITCH

Provides for selecting MICROAMMETER ranges. The highest range facilitates metering of charging current and the intermediate or lower ranges provide easier and more accurate indication of lower current.

VOLTAGE CONTROL

A continuously variable VOLTAGE control gives the operator smooth control of the output voltage from zero to maximum. This VOLTAGE control is equipped with a zero return interlock switch, making it necessary for the control to be at its zero output volts position before the high voltage control circuit can be energized. This prevents the sudden application of high voltage to the item under test.

METERED RETURN AND BYPASS TERMINALS AND GROUND SWITCH

The switch (located on the CONTROL SECTION) in conjunction with the METERED RETURN and BYPASS RETURN terminals (located on the HIGH VOLTAGE SECTION) provides a means for directing [illegible] either the [illegible]

CONTROL SECTION - Cont'd

RETURN or the BYPASS RETURN terminal.

By connecting the return side of the specimen to the METERED RETURN terminal and selecting BYPASS RETURN with the ground switch (which grounds the BYPASS RETURN terminal) all leakages from the high voltage connection to the specimen, to ground and other unwanted leakages to ground will be directed around the current meter. By selecting METERED RETURN with the GROUND switch (which grounds the METERED RETURN terminal), the total leakage to ground will flow through the current meter.

When testing a specimen that may have isolated metallic parts that provide a leakage path between the two points where the high voltage and return connections are made, the BYPASS RETURN terminal may be used as a guard circuit. If these isolated metallic parts are connected together and to the BYPASS RETURN terminal, any leakage from the high voltage point to these parts will be directed around the metering circuit.

NOTE: When using the BYPASS RETURN terminal as a guard circuit, the GROUND switch should be in the BYPASS RETURN position unless the specimen return side is earth ground. Under this condition the GROUND switch should be in the complete description and use of METERED RETURN and BYPASS RETURN terminals and GROUND switch.

HIGH VOLTAGE SECTION

CONTROL CABLE CONNECTOR

For connecting the CONTROL CABLE to the HIGH VOLTAGE SECTION.

CAUTION: DO NOT connect line cord until CONTROL CABLE is connected to BOTH CONTROL and HIGH VOLTAGE SECTIONS. DO NOT disconnect CONTROL CABLE until KILOVOLTMETER reads zero and LINE cord is disconnected.

GROUND TERMINAL

Provides external connection for high voltage cable shield and for SAFETY grounding the HYPOT case.

BYPASS AND METERED RETURN TERMINALS

See BYPASS RETURN and METERED RETURN TERMINALS and GROUND SWITCH in GENERAL FEATURES - CONTROL SECTION.

SAFETY INTERLOCK RECEPTACLE

The SAFETY INTERLOCK receptacle provides for interlocking the high voltage control circuit from a remotely located switch. This receptacle is electrically located in series with the high voltage lever switch, and has a jumper wire across the terminals of the mating plug as the instrument is shipped from the factory. To use the SAFETY INTERLOCK, remove the twist-lock plug from its receptacle and remove the jumper wire from its terminals. Connect the wires of the remotely located switch to the terminals of the plug and re-insert the plug into its twist-lock receptacle. While the remotely located switch is open, the high voltage control circuit will be disabled and no high voltage will be available at the output terminals. Removal of the set[illegible]

HIGH VOLTAGE SECTION

any other controls on the instrument. This switch must be closed in conjunction with the other conditions described under HIGH VOLTAGE SWITCH.

HIGH VOLTAGE OUTPUT TERMINATION

Disconnectable shielded high voltage cable.

CAUTION: This cable should NOT BE connected to the HIGH VOLTAGE SECTION until the CONTROL CABLE is connected to the CONTROL SECTION and HIGH VOLTAGE SECTION and the KILOVOLTMETER indicates zero.

OPERATING INSTRUCTIONS

The test operator must follow all accepted safety practices, proceed with caution, and do all in his power to assure a safe test. Because of the inherent dangers in any high-voltage work, special care must be taken to safeguard personnel during any testing.

1. Place the POWER and HIGH VOLTAGE switches on the OFF position.

2. Connect the CONTROL cable to the CONTROL and HIGH VOLTAGE sections.

3. Rotate the VOLTAGE control knob fully counter-clockwise.

4. Connect the LINE cord to a source of power as indicated on the nameplate.

5. Place the POWER switch on the ON position and allow a 90 second warm up period.

6. Connect the shield of the high voltage cable to the SAFETY GROUND terminal and plug the high voltage cable into the HIGH VOLTAGE OUTPUT.

7. Connect the item to be tested to the high voltage output cable and to the METERED RETURN terminal and select METERED RETURN with the GROUND switch (see GENERAL FEATURES section of this manual and DC HYPOT TESTINC MANUAL for complete description and use of this selective return circuit.

8. Turn the KILOVOLTS switch to the desired range.

9. Turn the MICROAMPERES switch to the required range depending on the expected leakage current. If the leakage current is unknown, turn this switch to the highest range.

10. Activate the H.V. switch to the ON position.

11. Rotate the VOLTAGE control clockwise until the required test voltage is indicated by the KILOVOLTMETER or until the maximum acceptable leakage current (as indicated by the MICROAMMETER) is reached.

12. The leakage current can be read on the MICROAMMETER. If greater sensitivity is desired, select a lower current range with the MICROAMPERES range switch.

13. The MICROAMPERES range or KILOVOLTS range may be changed at any time during a test to maintain best readability.

14. Should the item under test fail, high voltage will be de-energized.

15. To re-energize high voltage, repeat Steps 3 and 10.

16. To re-energize high voltage should the HV switch or POWER switch be turned OFF, or a remotely located switch be opened, it will be necessary to reclose the switch and repeat Steps 3 and 10.

MODEL 05321A

START S/N: 1195 & UP

APRIL 2, 1984

REPLACEMENT PARTS LIST

SYMBOL	PART NUMBER	D E S C R I P T I O N
	05321A-01	Amplivolt Assembly
	05321A-03	Cable Assembly Control
	05321A-04	Cable Assembly H. V. (Std. 15 ft.)
	05321A-07	Cable Assembly Kit
	05220A-07	Cable Assembly Ret. Black
	05220A-06	Cable Assembly Ret. Red
	08501-L05	Cable Assembly Ground
	05321A-30	Cap & Chain Assembly
C-1	10425	Capacitor, H.V. .47 MFD 600V
C-2	14476	Capacitor, 1 MFD, 1000V
CA-1	11649	Cable Input (6 ft.)
CB-1	31670	Circuit Breaker, 10A 220V
CN	11729	Connector Cable Twist Lock
FL-1	17709	Filter Capacitor, .004/.004 uF.
I-1	14159	Indicator Lamp Red
I-3	16437	Indicator Lamp, Type T2, 120V AC
NE-1,3-5	58591	Indicator Lamp Neon
NE-2	15485	Indicator Lamp Neon 1W
PL-1	11730	Plug. Cable (SAFETY INTERLOCK)
R-1,2	14791	Resistor, Fixed, 100K 1/2W 5%
R-3	11823	Resistor, Fixed, 499K, 1/2W 1%
R-4	11821	Resistor, Fixed 49.9K, 1/2W 1%
R-5	10853	Resistor, Fixed 4.99K 1/2W 1%
R-6	15294	Resistor, Fixed 499 Ohm, 1/2W 1%

MODEL 05321A

START S/N; 1195 & UP

APRIL 2, 1984

REPLACEMENT PARTS LIST

SYMBOL	PART NUMBER	D E S C R I P T I O N
R-10	14812	Resistor, Fixed 3.3K, 1/2W 1%
R-11	58334	Resistor, Fixed, 10K 1/2W 10%
R-12	14743	Resistor, Variable, 10K 2W,
R-13	14867	Resistor, Variable 5K, 2W
R-14	11825	Resistor, Fixed 10K, 1/2W 1%
R-15	10948	Resistor, Fixed 3.48K, 1/2W 1%
R-16	14790	Resistor, Fixed 22K, 1/2W 5%
RY-1	17779	Relay, 3 PDT 120V AC
RY-2	14203	Relay, Current Sense, SPDT 120V
S-1	16679	Switch, Toggle SPDT
S-2	59690	Switch, Toggle SPST
S-3	17621	Switch Micro 15Amp. 125V
S-4	16681	Switch, Rotary 4 Poles, 3 Pos.
S-5	16583	Switch, Rotary 4 Poles, 3 Pos.
T-1	58864	Transformer, Variable 120/0-120/140, 4Amp.
TER-1	11817	Terminal Post, Black
TER-2	20290	Bolt Hex 1/4-20
	20321	Nut Kep, 1/4-20
	20669	Washer 1/4-20 Flat
	58160	Nut Wing, 1/4-20
TER-3	11818	Terminal Post, Red
	58047	Resistor, Fixed 15K, 1/2W 1%
	10948	Resistor, Fixed 3.48K 1/2W 1%
	16211	Resistor, Variable, 25K, 1/8W, 30%
M-1	35600	Meter DC 50uA,w/Scale 10 uA DC
M-2	35599	Meter DC 50uA, w/Scale 5 uA DC

MODEL 05321A

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AMPLIFIER ASSEMBLY - 05220A-10

SYMBOL	PART NUMBER	D E S C R I P T I O N
C-1	10668	Capacitor, Elec., 20MFD, 250V
C-2,3	17175	Capacitor, Paper, .22 uF, 100V
R-1	10733	Resistor, Fixed, 36K, 1/2W, 5%.
R-2	14795	Resistor, Fixed, 68K, 1/2W, 5%.
R-3	58343	Resistor, Fixed, 2.2 MEG. 1/2W, 10%,
R-4,5	10514	Resistor, Fixed, 2.7K, 1/2W, 5%.
R-7	14723	Resistor, Variable, 1K, 2W, 20%.
R-8	17614	Resistor, Variable, 50K, 1/4W, 20%.
R-9	14743	Resistor, Variable, 10K, 2W.
R-10	58309	Resistor, Fixed, 47K, 1/2W, 5%.
R-11	18445	Resistor, Fixed, 1 MEG, 1/2W, 1%.
RT-1	14503	Rectifier, Silicon, Low Voltage.
T-1	11913	Transformer, Power, 117V.
V-1	15349	Tube, Vacuum, 12Au7A.

ASSOCIATED RESEARCH, INC.

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PHONE: (312) 647-7850
TELEX: 28-3511 ANSWERBACK CODE: ASOCRESCH NILE
CABLE: ASOCRESCH

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Insulation resistance...the MEG-CHEK®
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